SD11
A525
151

Technical Paper 151
October 1956

Increase Your Profit in the Woods

Roy A. Whitmore, Jr.
Willard L. Jackson

LIBRARY
FEB 12 1960
ROCKY MOUNTAIN STATION

Central States Forest Experiment Station
U. S. DEPARTMENT OF AGRICULTURE FOREST SERVICE

This report is from the
Division of Forest Economics
CENTRAL STATES FOREST EXPERIMENT STATION

The authors gratefully acknowledge the assistance of staff members of the Forest Products Laboratory, Madison, Wisconsin, particularly Coleman L. Vaughan, in planning the research project of which the results reported here are a part.

Carbondale (Illinois) Forest Research Center
Division of Forest Management
(Maintained in cooperation with
Southern Illinois University, Carbondale, Illinois)

Robert W. Merz, Forester in Charge

Central States Forest Experiment Station, U. S. Dept. of Agriculture
Forest Service, 111 Old Federal Building, Columbus 15, Ohio
W. G. McGinnies, Director

SUMMARY

This study was made to find out how much a timber operator's profits could be increased by proper application of log grades when bucking, and by more complete utilization of the merchantable stem. Logs from 203 black oak trees cut on 10 commercial logging operations in southern Illinois were diagrammed and then graded: first, as they were actually bucked; and second, for the highest possible quality recovery. By comparing these two bucking systems, it was found that:

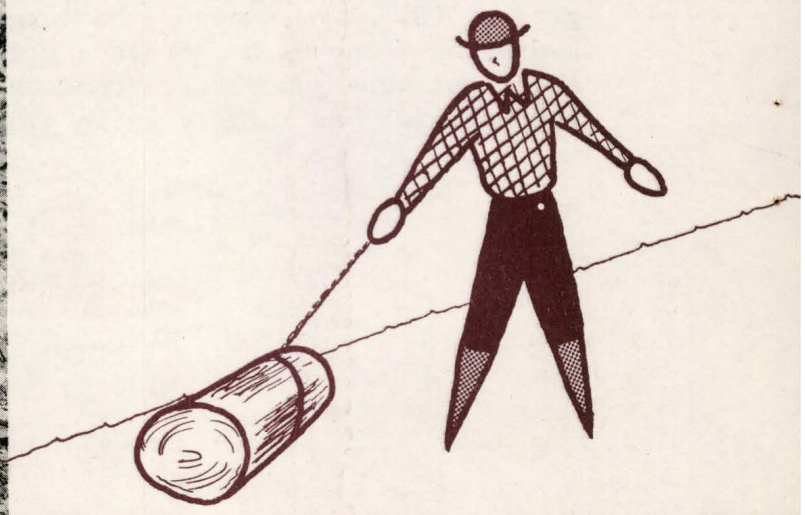
1. In commercial practice, 23 percent of the total net volume cut was in Factory Grade 1 logs; if bucked for optimum recovery, 34 percent of the total net volume of these same trees would have been Factory Grade 1 logs.

2. Five percent more bucking cuts were needed to obtain this increased grade recovery, but the total net volume recovered was 4 1/2 percent greater than that actually bucked. It took 8.6 bucking cuts per thousand board-feet by each method.

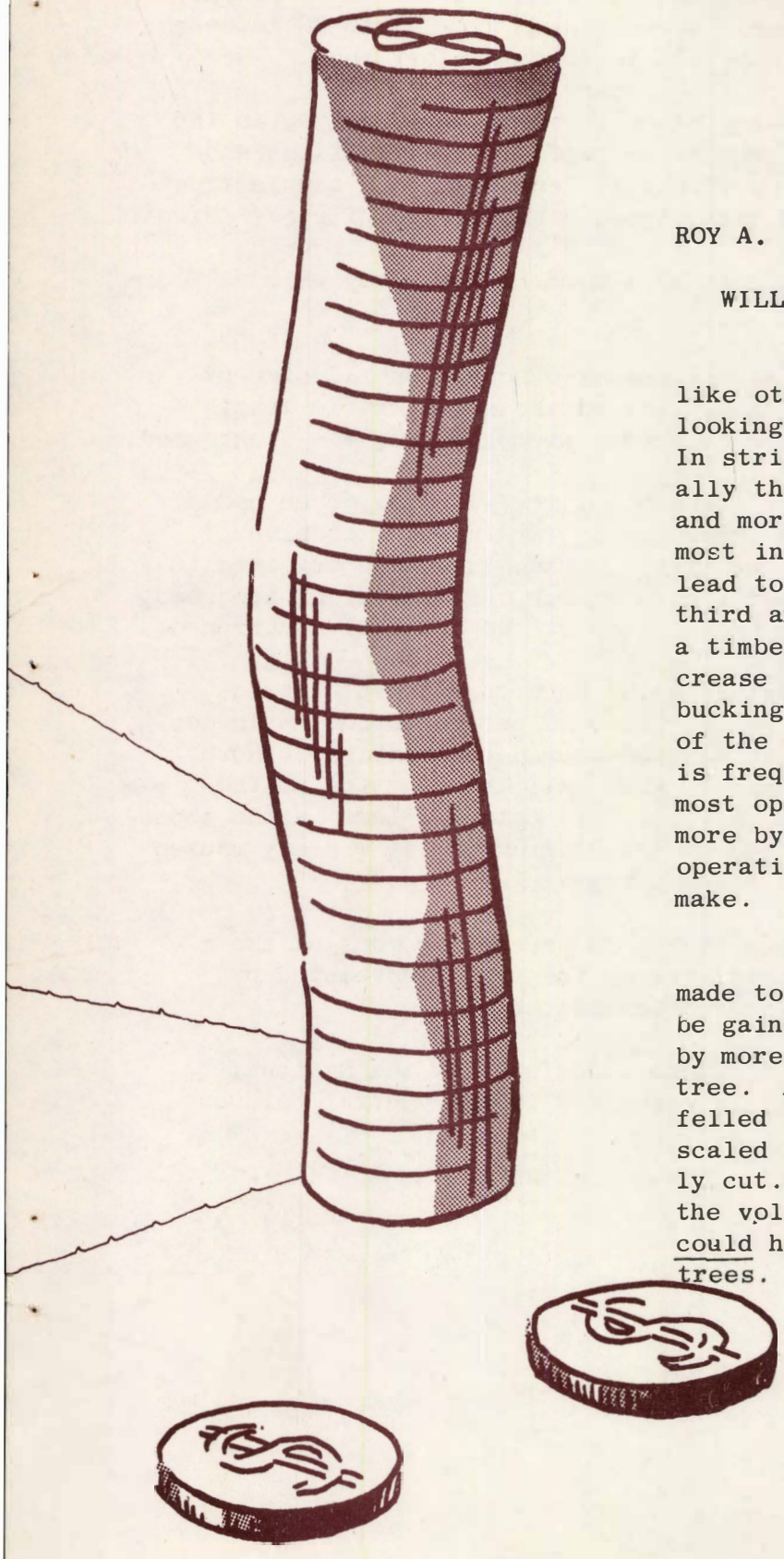
3. There were some changes in the distribution of log lengths between the two bucking methods. However, the average log length in both cases was approximately 12.5 feet. The volume of 16-foot logs was increased 60 percent by quality bucking.

4. If the trees studied had been bucked for optimum grade, the operator's margin for profit and risk would have been increased by 116 percent.

5. The major reasons for loss of quality and volume recovery were: (1) woods crews were not familiar with log grades; (2) 35 percent of the trees were cut with stumps averaging 5 inches higher than standard; (3) 8 percent of the trees were jump-butted unnecessarily; (4) merchantable top material was left lying in the woods.



INCREASE YOUR PROFIT IN THE WOODS



ROY A. WHITMORE, JR., forest economist

WILLARD L. JACKSON, technologist

Timber operators and sawmillers, like other businessmen, are constantly looking for ways to increase profits. In striving toward this end, they usually think first of improved equipment and more efficient use of labor. In most instances, both of these will lead to greater returns. However, a third and equally promising way for a timber or sawmill operator to increase his profits is through better bucking and more complete utilization of the trees purchased. This approach is frequently overlooked, even though most operators would probably benefit more by it than by any other single operational improvement they could make.

The study reported here was made to find out just how much could be gained by "bucking for grade" and by more complete utilization of each tree. All logs from more than 200 felled and bucked black oak trees were scaled and graded as they were actually cut. Results were compared with the volume and grade of material that could have been cut from the same trees.

Field Procedure

The sample trees were taken from 10 different logging operations in southern Illinois. These operations included three types of sales: (1) marked timber on the Shawnee National Forest, (2) marked timber on private land, and (3) unmarked timber on private land. Diameters of the sample trees ranged from 14 to 32 inches; merchantable height, from one-half to three 16-foot logs.

So that the basic data collected would have meaning in the future, regardless of any changes in product specifications and grading rules, the entire merchantable length of each sample tree was diagrammed to show the size, type, and location of every defect.

The merchantability standards used in the study were as follows:

Stumps.--A 12-inch stump, measured on the uphill side of the tree, was used as standard. The entire merchantable length above this point, regardless of actual stump height, was diagrammed.

Upper limits.--Upper merchantability was considered ended where the central stem was broken up by forking or excessive branching, whichever occurred first. Branching was considered to be excessive when the diameter of a branch, or cluster of branches, exceeded half the diameter of the stem at the point of occurrence.

Top material.--Material in the upper portion of a tree (limbs, forks, etc.) that was at least 50 percent sound, 8 inches d.i.b., and 8 feet in length was considered merchantable. Here again, no knots or branches more than half the diameter at the point of occurrence were permitted. All material left in the tops that met these minimum standards was diagrammed, as was any unused merchantable material left below a fork.

Allowable cull.--Logs having 50 percent or more of their gross volume in sound material (using the system developed by Grosenbaugh (1)) were considered merchantable.

These standards approximate those used by the National Forests, and by State and farm foresters in the Central Hardwood Region.

Office Procedure

The diagrammed logs were graded in the office using the Forest Service Hardwood Log Grades for Factory Lumber developed by the Forest Products Laboratory (4) (fig. 1). All merchantable logs not qualifying for the factory grades were classified as "local-use" logs (2).

Grade factors	Log Grade 1			Log Grade 2		Log Grade 3
	Butts only	Butts and uppers		Butts and uppers		Butts and uppers
DIAMETER (minimum)	13"-15"	16"-19"	20"+	11		8"+
LENGTH (minimum)	10'+	10'+		8'-11'	12'+	8'+
CLEAR CUTTINGS (on the 3 best faces)						
Length (minimum)	7'	5'	3'	3'		2'
Number on face (maximum)	2	2		2	3	Unlimited
Yield in face length (minimum)	5/6	5/6		4/6		3/6
SWEEP AND CROOK DEDUCTION (maximum)	15%	15%		30%		50%
CULL DEDUCTION, including sweep (maximum)	40%	40%		50%		50%

Exceptions.--In ash and basswood 12" d.i.b. for grade 1 butts.
Grade 2 10" d.i.b. must be grade 1 surface quality.
Grade 2 11" d.i.b. limited to two cuttings.
Grade 2 8' and 9' lengths limited to 12" d.i.b.; 3/4 yield in not more than two 3'+ cuttings.
Sweep and crook allowance reduced 1/3 in logs with more than 1/4 diameter in sound end defects.
Sixty percent cull deduction permitted in grade 2 if otherwise of grade 1 quality.
Sixty percent cull deduction permitted in grade 3 if otherwise of grade 2 quality.

Forest Products Laboratory; Madison, Wisconsin; March 10, 1949

Figure 1.--Hardwood log grades for factory lumber.

Every tree was graded twice. First, each log was graded exactly as it was cut, that is, on the basis of commercial bucking. Second, by using the diagrams, the tree was "re-assembled" and then "bucked" to obtain the most advantageous combination of quality and volume recovery possible. Sweep, crook, and the location of grading defects were considered in locating bucking cuts for optimum grade recovery. Logs were "bucked" in even-foot lengths from 8 to 16 feet. Merchantable material in high stumps, jump-butts, jump-cuts, and tops was included in arriving at optimum tree value.

The value of the logs recovered by each of the bucking systems was found by computing a "quality index"1/ for each log grade and then multiplying these figures by the price of No. 1 common lumber. These average values per thousand board-feet for the various log grades were then multiplied by the volume of each specific log grade produced to find the product value in dollars for each bucking method.

1/ Quality index is the summation of the percents of each lumber grade found in a log of given size and grade multiplied by the price per thousand board-feet of each lumber grade and divided by the price of No. 1 common lumber.

COMPARING THE RESULTS

Effect of Bucking Method on Volume Recovery and Log Length Distribution

The loggers on the various operations studied made a total of 461 bucking cuts to get 433 logs containing nearly 54 thousand board-feet of timber (International 1/4 inch scale). When "bucked" in the office for maximum tree value, 484 "cuts" from the same trees yielded 469 logs totaling more than 56 thousand board-feet. Both methods required 8.6 bucking cuts per thousand board-feet.

The increased volume as a result of quality bucking came from three sources: high stumps, jump-butts, and tops.

High stumps.--High stumps are cut for various reasons: because of swelled butts, butt flutes and flanges, fire scars, carelessness, or just plain aversion to stooping. More than one-third of the 203 black oak trees in this study were cut with stumps averaging 17 inches above the ground level, that is 5 inches higher than standard. These high stumps contained 665 board-feet of high-quality material (fig. 2).

Jump-butts.--The lower portions of the butt logs from 17 of the 203 sample trees were cut off, or jump-butted, in order to remove cull material. These jump-butts, averaging more than 3 feet in length, contained a gross volume of 626 board-feet and a net volume of 373 board-feet. According to established merchantability standards, only 3 of the 17 cuts were justified, and these 3 were cut longer than was necessary (fig. 3). Based on these standards, 505 board-feet of the gross volume found in the 17 jump-butts should have been taken to the mill. These butts contained 362 board-feet of sound material.

Figure 2.--Stump cut 10 inches above standard height. The unutilized section is clear of surface defects, has a top d.i.b. of 15 inches, and contains an estimated 9 board-feet of high-quality material.

Top material.--Merchantable top material was wasted from 29 of the 203 trees studied. This amounted to a gross volume of 1,052 board-feet and a net volume of 998 board-feet (figs. 4 and 5).

While most operators are aware that grade can be increased by careful bucking, many feel that it can be done only by sacrificing log length. In this study, bucking for grade did increase the volume in 8- and 10-foot logs over that produced commercially, but it also greatly increased the volume in 16-foot logs (table 1). Average log length in both cases was approximately 12.5 feet.

Table 1.--Net volume distribution by log length as influenced by bucking method

Log length in feet	Commercial bucking		Bucking for grade	
	Board-feet	Percent	Board-feet	Percent
8	1,247	2	5,140	9
10	5,837	11	10,822	19
12	18,790	35	11,420	20
14	15,459	29	8,345	15
16	12,435	23	20,515	37
Total	53,768	100	56,242	100

Figure 3.--Unnecessary 7-foot jump-butt. This surface-clear section, 18 inches d.i.b. on the small end and containing 95 board-feet gross scale, was left in the woods. Cull volume is estimated at 16 board-feet, (17 percent) due to a 6-inch circular area of shake and rot extending through the section (1). The remaining net volume, 79 board-feet (83 percent) of high-quality material, was wasted.

Figure 4.--Underutilized top material below a fork. One 12-foot log was taken below the cut, leaving this 2-foot high, 17-inch d.i.b., surface-clear section in the woods. Twenty-three board-feet of high-quality material was wasted.

Effect of Bucking Method on Grade Recovery

Although bucking for optimum tree value did increase volume recovery, its big advantage over commercial bucking was in greater production of high-grade logs. In actual practice, 23 percent of the volume recovered by the commercial operators was in Factory Grade 1 logs. But, when the same trees were "bucked" for grade from the diagrams, 34 percent of the net volume was in Factory Grade 1 logs. At the same time the volume of "local-use" logs was cut in half.

A sawyer of average skill should produce about 68 percent No. 1 common and better lumber from Factory Grade 1 logs, 32 percent from Grade 2 logs, 19 percent from Grade 3 logs, and 12 percent from "local-use" logs (4), (5). About 18,300 board-feet of the lumber cut from the logs as actually bucked would have been No. 1 common and better. On the other hand, if the trees had been bucked for optimum grade, the same sawyer would have recovered about 22,200 board-feet of No. 1 common and better lumber from the logs produced, an increase of 21 percent.

The major factor contributing to increased quality recovery was proper application of log grades in the bucking operation. The other important item was the salvage of high-quality material from high stumps and unnecessary jump-butts.

Figure 5.--Unutilized top log above a fork. This 14-foot section, with a small end d.i.b. of 14 inches and Grade 2 surface quality, was left in the woods. One hundred and fifteen board-feet of material was wasted.

Effect of Bucking Method on Product Value and Profit Margin

Since quality bucking produced better logs--and thus, better lumber--its advantage over commercial bucking can be clearly shown in dollars and cents in terms of product values and the operator's net gain. As actually bucked by the commercial operators, the black oak trees harvested during this study would have yielded lumber worth about $4,110. Had the same trees been bucked for optimum value, the lumber produced would have been worth $4,616, an increase of $506 (table 2).

Table 2.--Volume and value of logs by grade and bucking method

Log grade	Commercial bucking			Quality bucking		
	Net volume		Value[1/]	Net volume		Value[1/]
	Board-feet	Percent	Dollars	Board-feet	Percent	Dollars
F-1	12,206	23	1,370	19,054	34	2,138
F-2	18,735	35	1,360	18,184	32	1,320
F-3	18,220	34	1,122	16,682	30	1,028
Local use	4,607	8	258	2,322	4	130
Total	53,768	100	4,110	56,242	100	4,616

1/ Based on the following average quality indexes: 1.02 for F-1 logs; 0.66 for F-2 logs; 0.56 for F-3 logs; and 0.51 for "local-use" logs. These figures were applied to the current price for 4/4 No. 1 common lumber--$110 per thousand board-feet.

Based on average production costs[2]/ obtained informally from private loggers, from cost studies on the Kaskaskia Experimental Forest, and from bids on recent Shawnee National Forest timber sales, the profit margin by quality bucking was $12.16 per thousand board-feet, in contrast to only $5.62 by commercial bucking, an increase of 116 percent.

DISCUSSION AND CONCLUSIONS

The results of this study show that a timber operator can significantly increase the total value of the logs he produces--and the profit he makes from them--by more careful bucking. Greater profits benefit the commercial operator immediately, and in the long run mean higher stumpage returns for the timber owner. There are two basic requirements for the realization of the optimum value from trees harvested: each tree must be cut for maximum recovery of high-grade logs, and the merchantable volume in each tree must be fully utilized.

Buck Logs for Best Grade

High-grade lumber is found in areas clear of defects such as knots, holes, and bud clusters. Thus, recognizing these defects on the tree stem and bucking in accordance with the clear-cutting requirements of the log grades are prime considerations when bucking for quality (3).

In addition to surface defects, crook and sweep also affect log quality. Crooked logs lose a lot of volume on the saw carriage in the form of heavy slabs. A higher percentage of narrow boards is produced and the low-grade heart of the log appears sooner. All of these reduce the average value of the lumber cut from the log. Careful selection of bucking points can eliminate or minimize crook and sweep, and so prevent much needless waste of volume and quality.

In order to increase profits, crews must be trained in the use of log grades, and then given an incentive to apply them in the production of quality logs. A sliding wage scale, paying more per thousand for higher grade logs than for lower grades is one method. Bonus payments for every thousand feet of Grade 1 and 2 logs produced would have the same effect: more high-grade logs, and thus more profit for the operator.

2/ Felling and bucking, $7.00; skidding, $5.00; load, haul, and unload, $10.00; milling, $18.00; air drying, $10.00; and black oak stumpage, $20.00. All costs per thousand board-feet.

Fully Utilize the Merchantable Volume

All the merchantable volume in a tree must be used if full value is to be realized from each tree cut. By following a few simple rules and doing a little planning before bucking, the lengths of logs cut from a tree can be varied so that no merchantable sections are wasted anywhere along the stem. Since hardwood logs are generally cut in even-foot lengths (8, 10, 12 feet, etc.), there is generally no reason for leaving more than 1 foot of merchantable length in the woods.

Cut low stumps and keep jump-butts to a minimum.--Stump height may seem to be of small significance on an individual tree basis. Cumulatively, however, stumps cut too high can result in much loss of volume. Even more important, clear material wasted in a high stump may lower the grade of the butt log by reducing the length of clear cuttings available. Stumps should be cut as low as possible, since every inch of clear material is important in meeting the grading specifications for high-grade logs.

For the same reasons, care should be taken in bucking trees that have some cull in the butt. The butt log represents the major portion of an average tree's value. Within this log, the bulk of the value is concentrated in the clear wood growing outside the knotty core; the low-grade heart itself contributes little. Therefore, center-cull has little effect on the value and grade of a log as long as the minimum allowable cull percent for the particular grade is not exceeded. Under these conditions, it makes little sense to waste high-quality material, representing a large part of the tree's value, in the form of jump-butts. In general, the fewer the number and the smaller the size of jump-butts cut, the greater will be the recovery of high-value logs.

Use top logs.--Merchantable top material left lying in the woods is another source of potential income for a timber operator. Top logs rarely yield much high-grade lumber, but can ordinarly pay their own way out of the woods. This is usually true even when an extra bucking cut is required to produce an additional log. The increased value is even more apparent when the top log of a tree can be made several feet longer without the expense of another bucking cut.

Defects such as large limbs, excessive crook, forks, excessive rot, and small diameters in the upper portion of a tree obviously limit merchantability. It is well worth an operator's time and effort, however, to insist on careful bucking so that the top of the last log and the end of merchantability coincide and no merchantable material is wasted.

LITERATURE CITED

(1) Grosenbaugh, L. R.
1952. Shortcuts for cruisers and scalers. U. S. Forest Serv., South. Forest Expt. Sta. Occas. Paper 126, 24 pp., illus.

(2) Lockard, C. R.
1949. Supplementary information on hardwood log grading. Forest Util. Serv., Northeast. Forest Expt. Sta., 15 pp., Mimeo.

(3) Lockard, C. R., Putnam, J. A., and Carpenter, R. D.
1950. Log defects in southern hardwoods. U. S. Dept. Agr. Handb. 4, 37 pp., illus.

(4) U. S. Forest Service
1949. Hardwood log grades for standard lumber; proposals and results. Forest Prod. Lab. Report D1737, 15 pp., illus.

(5) Whitmore, R. A. and Jackson, W. L.
1956. Lumber grade recovery from sub-factory grade black and upland red oak logs. Preposed Station Note, Cent. States Forest Expt. Sta.

TERRITORY SERVED BY THE

CENTRAL STATES FOREST EXPERIMENT STATION

FOREST SERVICE

U. S. DEPARTMENT OF AGRICULTURE